National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: March 2, 2012

In reply refer to: R-12-5 through -8
R-07-4 (Reiteration)

The Honorable Cynthia L. Quarterman
Administrator
Pipeline and Hazardous Materials
Safety Administration
Washington, D.C. 20590

About 8:36 p.m., central daylight time, on Friday, June 19, 2009, eastbound Canadian National Railway Company (CN) freight train U70691-18, traveling at 36 mph, derailed at a highway/rail grade crossing in Cherry Valley, Illinois. The train consisted of 2 locomotives and 114 cars, 19 of which derailed. All of the derailed cars were tank cars carrying denatured fuel ethanol, a flammable liquid. Thirteen of the derailed tank cars were breached or lost product and caught fire. At the time of the derailment, several motor vehicles were stopped on either side of the grade crossing waiting for the train to pass. As a result of the fire that erupted after the derailment, a passenger in one of the stopped cars was fatally injured, two passengers in the same car received serious injuries, and five occupants of other cars waiting at the highway-rail crossing were injured. Two responding firefighters also sustained minor injuries. The release of ethanol and the resulting fire prompted a mandatory evacuation of about 600 residences within a 1/2-mile radius of the accident site. Monetary damages were estimated to total $7.9 million.[1]

The National Transportation Safety Board (NTSB) determined that the probable cause of the accident was the washout of the track structure that was discovered about 1 hour before the train's arrival, and the CN's failure to notify the train crew of the known washout in time to stop the train because of the inadequacy of the CN's emergency communication procedures. Contributing to the accident was the CN's failure to work with Winnebago County to develop a comprehensive storm water management design to address the previous washouts in 2006 and 2007. Contributing to the severity of the accident was the CN's failure to issue the flash flood warning to the train crew and the inadequate design of the DOT-111 tank cars, which made the cars subject to damage and catastrophic loss of hazardous materials during the derailment.

[1] See *Derailment of Canadian National Railway Company Freight Train U70691-18 With Subsequent Hazardous Materials Release and Fire, Cherry Valley, Illinois, June 19, 2009*, Railroad Accident Report NTSB/RAR-12/01 (Washington, DC: National Transportation Safety Board, 2012) on the NTSB website at <http://www.ntsb.gov>.

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EXHIBIT A

Damage to Tank Heads, Shells, and Top Fittings

During a number of accident investigations over a period of years, the NTSB has noted that DOT-111 tank cars have a high incidence of tank failures during accidents. Previous NTSB investigations that identified the poor performance of DOT-111 tank cars include a May 1991 safety study[2] as well as NTSB investigations of a June 30, 1992, derailment in Superior Wisconsin;[3] a February 9, 2003, derailment in Tamaroa, Illinois;[4] and an October 20, 2006, derailment of an ethanol unit train in New Brighton, Pennsylvania.[5] In addition, on February 6, 2011, the Federal Railroad Administration (FRA) investigated the derailment of a unit train of DOT-111 tank cars loaded with ethanol in Arcadia, Ohio, which released about 786,000 gallons of product.

The fact that DOT-111 general service tank cars experience more serious damage in accidents than pressure tank cars, such as DOT-105 or the DOT-112 cars, can be attributed to the fact that pressure tank cars have thicker shells and heads. The pressure cars are also usually equipped with metal jackets, head shields, and strong protective housings for top fittings. They do not have bottom outlet valves, which have been proven to be prone to failure in derailment accidents.

Of the 15 derailed DOT-111 tank cars that piled up in this accident, 13 cars lost product from head and shell breaches or through damaged valves and fittings, or a combination of the two. This represents an overall failure rate of 87 percent and illustrates the continued inability of DOT-111 tank cars to withstand the forces of accidents, even when the train is traveling at 36 mph, as was the case in this accident. Head breaches resulting in the release of denatured fuel ethanol occurred in 9 of the 15 tank cars in the pileup. Head failures in seven of the cars were apparently caused by coupler or draft sill strikes. Two of the tank heads were breached by other striking objects or tank car structures. Additionally, side shells of three of the tank cars were breached as a result of car-to-car impacts. Clearly, the heads and shells of DOT-111 tank cars, such as those that are used to transport denatured fuel ethanol in unit trains, can almost always be expected to breach in derailments that involve pileups or multiple car-to-car impacts. The inability of the DOT-111 tank car heads and shells to retain lading in this accident is comparable with previously mentioned ethanol unit train accidents that occurred in New Brighton, Pennsylvania, in which 12 heads or shells were breached of 23 derailed tank cars, and in Arcadia, Ohio, in which 28 heads and shells of 32 derailed tank cars were breached.

DOT-111 tank cars make up about 69 percent of the national tank car fleet, and denatured fuel ethanol is ranked as the largest-volume hazardous materials commodity shipped by rail. This accident demonstrates the need for extra protection such as head shields, tank jackets, more robust top fittings protection, and modification of bottom outlet valves on DOT-111 tank cars

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[2] NTSB/SS-91/01.

[3] *Derailment of Burlington Northern Freight Train No. 01-142-30 and Release of Hazardous Materials in the Town of Superior, Wisconsin, June 30, 1992*, Hazardous Materials Accident Report NTSB/HZM-94/01 (Washington, DC: National Transportation Safety Board, 1994) <www.ntsb.gov/>

[4] *Derailment of Canadian National Freight Train M33371 and Subsequent Release of Hazardous Materials in Tamaroa, Illinois, February 9, 2003*, Accident Report NTSB/RAR-05/01 (Washington, DC: National Transportation Safety Board, 2005). <www.ntsb.gov/>

[5] NTSB/RAR-08/02.

used to transport hazardous materials. The NTSB concluded that if enhanced tank head and shell puncture-resistance systems such as head shields, tank jackets, and increased shell thicknesses had been features of the DOT-111 tank cars involved in this accident, the release of hazardous materials likely would have been significantly reduced, mitigating the severity of the accident.

Although hazardous materials are better protected when transported in pressure tank cars, the majority of the fleet of pressure tank cars, which are currently used for other hazardous materials such as liquefied petroleum gas, chlorine, and anhydrous ammonia, would be required to supply the demand for ethanol transportation alone. The FRA estimates there are about 40,000 class DOT-111 general service tank cars currently in ethanol service, while the total fleet of pressure tank cars of all specifications consists of about 62,000 cars.[6] Since this accident, the Association of American Railroads (AAR) has opted to increase the crashworthiness of newly constructed class DOT-111 tank cars used in ethanol and crude oil service in Packing Groups[7] I and II. AAR requirements for new tank cars increase the minimum head and shell thickness to 1/2 inch for TC-128B nonjacketed cars and 7/16 inch for jacketed cars. Shells of nonjacketed tank cars constructed of A516-70 steel must now be 9/16 inch thick; shells of jacketed cars must be 1/2 inch thick. The AAR requirements also specify that both the heads and the shells must be constructed of normalized steel and that in all cases, a 1/2-inch-thick head shield must be provided.

The AAR requirements do not provide a retrofit solution for the existing fleet of about 40,000 tank cars that are dedicated to transporting denatured fuel ethanol. In its March 9, 2011, petition for rulemaking, the AAR specifically recommended that no provisions be adopted to require modifications or retrofitting of existing DOT-111 tank cars. In the petition, the AAR notes that it considered applying risk-reduction options both to the existing fleet and to new tank cars; however the Railway Supply Institute conservatively estimates the cost of retrofitting existing cars with head shield and jackets to be more than $1 billion over the life of a retrofit program, not including cleaning and out-of-service costs. The AAR argues, by contrast, that a member survey for information on the consequences of derailments involving Packing Groups I and II hazardous materials from 2004 to 2008 found 1 fatality, 11 injuries and the release of approximately 925,000 gallons of materials with associated cleanup costs of approximately $63 million.

The AAR cited other impediments to retrofitting DOT-111 tank cars with head shields or jackets. For example, the AAR contends that the extra weight of these safety features could overload tank cars designed to 263,000 pounds gross rail load even when the cars' draft sills are designed for 286,000 pounds. While increasing the thickness of existing tank car tank heads and shells would require replacement of the tank, retrofitting tank cars with head protection systems is not without precedent. When improved tank car construction specifications were adopted for certain tank cars used to transport flammable gasses, anhydrous ammonia, or ethylene oxide, the Research and Special Programs Administration (RSPA) took action to prohibit the use of tank cars built to older construction standards for these products. On January 27, 1984, RSPA issued a final rule that required after December 31, 1986, all DOT-105 tank cars constructed before

[6] Association of American Railroads, UMLER, February 2009.

[7] The *packing group* indicates the degree of danger presented by a hazardous material in transport. Packing Group I indicates great danger; Packing Group II, medium danger; and Packing Group III, minor danger.

March 1, 1981, as well as all DOT-111 tank cars used to transport these specifically identified hazardous materials to be equipped with the same tank head and thermal safety systems that are required on newly built DOT-105 tank cars and on all specification DOT-112 and DOT-114 tank cars used to transport those same hazardous materials.[8] The final rule noted that RSPA took this action to increase the safety of transportation by rail of hazardous materials.

The FRA reported that there are currently no plans to require phase-out or retrofitting of existing tank cars in the ethanol fleet.[9] The decision to not phase out or retrofit existing tank cars allows new DOT-111 tank cars with improved protection to be commingled in unit train service with the existing fleet of insufficiently protected tank cars. The decision thus ignores the safety risks posed by the current fleet of about 40,000 ethanol tank cars that are on average 8 years old with an estimated service life of 30 to 40 years. There will be increasing need for general service tank cars to meet transportation demands due to the mandated tripling of the amount of ethanol blended into the nation's fuel supply by 2022. Notwithstanding the anticipated growth in the volume of ethanol transported by railroad, existing DOT-111 tank cars will continue to make up a large percentage of the tank car fleet for many years.

In addition, the FRA reports recent orders for 10,000 new general service tank cars to provide for crude oil unit train transportation in the northwest United States and Canada due to the lack of pipeline infrastructure. Tank cars for crude oil service have the same specifications as cars used for ethanol, therefore design alternatives would easily apply to tank cars in both services. Over the past 3 years, rail shipments of crude oil from the Bakken region of North Dakota alone have increased from 500 carloads to more than 13,000 carloads, and volume is expected to grow to 70,000 carloads annually.[10] There would be significant benefit to developing improved design standards prior to construction of large numbers of additional tank cars, such as avoiding the need to later include these cars in a retrofit or phase-out program.

Improvements in tank car safety would most effectively be targeted to those hazardous materials commodities that are transported by unit train, such as denatured fuel ethanol and crude oils, and which pose the greatest risks when released, such as those commodities in Packing Groups I and II. The risks are greater in unit train operations because hazardous materials are transported in high density. For example, a unit train of 75 to 100 fully loaded 30,000-gallon tank cars typically transports between 2.1 million and 2.8 million gallons of hazardous materials per train.

Considering that 10 of the 13 cars that released product in this accident did so as a result of punctures and fractures of the tank heads and shells, the NTSB welcomes the AAR's actions requiring that new DOT-111 tanks cars built for Packing Groups I and II service have head shields and be constructed of thicker and higher quality steels. However, these actions do not address existing tank cars and would not ensure that all tank cars used to transport hazardous materials such as fuel ethanol will meet enhanced puncture resistance standards. Because of the impediments to retrofitting the existing tank car fleet with puncture-resistance systems, a phase-out of existing tank cars to other service may be the best option for the immediate future. The NTSB

[8] *Federal Register*, vol. 49, no. 19 (January 27, 1984), pp. 3468–3473.

[9] E-mail communication with FRA Hazardous Materials Division staff, November 2, 2011.

[10] Association of American Railroads' *Insider Newsletter*, December 12, 2011.

concluded that the safety benefits of new specification tank cars will not be realized while the current fleet of DOT-111 tank cars remains in hazardous materials unit train service, unless the existing cars are retrofitted with appropriate tank head and shell puncture resistance systems.

Top fittings on tank cars generally project from the tank and are thus vulnerable to impact damage in derailments where the fittings may impact the ground or another object with the entire weight and momentum of the tank car behind it. Although housings used to protect the top fittings of DOT-111 tank cars involved in this accident were fabricated in accordance with Title 49 *Code of Federal Regulations* (CFR) 179.200-16, the postaccident inspection of the derailed tank cars revealed that the housings were not effective in preventing damage to the top fittings of two tank cars, resulting in subsequent loss of lading.[11] While the housing did protect the fittings in the case of one car, which came to rest lying upside down in soft mud, the top fittings were damaged in other instances where the housings contacted less compliant objects. In one case, the housing separated from the car, and both the liquid and vapor valves were sheared from their threaded pipes, thereby causing the car to lose about 26,357 gallons of product. The housing cover of another car was knocked askew in the derailment, breaking the vapor valve from its fitting and contributing to the release of product from that car. Clearly, unprotected top fittings are vulnerable to impact damage and release of hazardous materials even when tank cars are otherwise less severely damaged, as was the case with the tank cars described above. The NTSB concluded that requirements for protection of the top fittings of the DOT-111 tank cars involved in this accident are inadequate because the protective housings were not able to withstand the forces of the derailment.

In order to demonstrate the viability of possible solutions for top fittings protection for non-pressure tank cars, the FRA, in October 2009, published the preliminary results of a report following testing of three concepts: adding a roll bar assembly to the top of the tank; incorporating a fabricated deflective skid to the top of the tank; and recessing the fittings into the interior of the tank.[12] Under an FRA contract, researchers created computer models, designed the concepts, and conducted full-scale dynamic rollover tests as recently as August 2010 in order to validate the models. Each of the concepts proved effective in preventing rollover damage to the top fittings; however, the Pipeline and Hazardous Materials Safety Administration (PHMSA) has not initiated rulemaking to require enhanced top fittings protection for general service tank cars.

Notwithstanding PHMSA's inaction in mandating top fittings protection, the AAR, which by regulation is responsible for approving tank car designs, as of July 1, 2010, now requires that all new non-pressure tank cars used to transport Packing Groups I and II hazardous materials be equipped with discontinuity protection[13] housings for top fittings. The top fittings are subject to an impact performance standard incorporated into AAR's *Manual of Standards and Recommended Practices*. Essentially, top fittings may be grouped inside a more robust pressure-car-type protective housing or mounted on nozzles or flanges within rollover skid

[11] One tank car released product from both a damaged top fitting and a bottom outlet valve.

[12] *Survivability of Railroad Tank Car Top Fittings in Rollover Scenario Derailments Phase 2 Final Report*, Federal Railroad Administration Report DOT/FRA/ORD-09-20 (Washington, DC: U.S. Department of Transportation, 2009).

[13] *Discontinuity protection* refers to a housing or skid-plate structure designed to protect fittings and valves from damage in a derailment.

protection. Although the top liquid and vapor valve fittings on the derailed tank cars were contained within a housing, this housing was not nearly as strong as a pressure-car-type protective housing that would be required by the new AAR standard.

The current AAR standard addresses new construction only and does not require retrofitting of the current tank car fleet with top fittings protection. With approximately 40,000 existing DOT-111 tank cars that the FRA estimates are transporting denatured fuel ethanol with an estimated service life of 30 to 40 years, this represents the potential for tank cars with inadequately protected top fittings to continue to release products in accidents.

Therefore, the NTSB recommends that PHMSA require that all newly manufactured and existing general service tank cars authorized for transportation of denatured fuel ethanol and crude oil in Packing Groups I and II have enhanced tank head and shell puncture resistance systems and top fittings protection that exceeds existing design requirements for DOT-111 tank cars.

Damage to Bottom Outlet Valves

During the derailment, three bottom outlet valves opened as a result of valve operating levers being bent and pulled away from their retaining brackets. The bottom outlet nozzles were also sheared-off outward of discontinuity protection during the derailment, thus exposing the open outlet valves. The open bottom outlet valves resulted in the release of most, if not all, of the product from the respective cars.

Bottom outlet discontinuity protection of the type that existed on the accident tank cars has been shown to be of limited effectiveness in preventing product releases from bottom outlets during accidents. Cited in the Transportation Research Board report on *Ensuring Tank Car Safety*, the AAR and the Railway Progress Institute reviewed the accident data for lading releases from bottom outlet valve damage and found that tank cars with damaged bottom outlets had a 30-percent failure rate when protected, compared with a 66-percent failure when non-protected. The rate of release for even the protected bottom outlet valves thus remains at such frequency that it is likely that some DOT-111 tank cars will release product during derailments involving a substantial number of these cars.

One of the derailed cars with an open bottom outlet valve was a CIT Rail-owned car with a bottom outlet valve and handle configuration that had been modified from the original design. The bottom outlet valve handle on the car was constructed with a breakaway point that was designed to allow the handle to break free in an accident without causing the valve to open. But the valve operating handle was too robust and failed to break away when the handle struck the ground or another object. Instead, the retaining bracket broke, and the intact handle, though bent, opened the valve and allowed lading to be released.

The AAR *Manual of Standards and Recommended Practices Specifications for Tank Cars* specifies that: "bottom outlet valve handles ... must be designed to either bend or break free on impact, or the handle in the closed position must be located above the bottom surface of the skid." In the modified valve arrangement, although the handle was designed to bend or break free on impact, the end of the handle protruded outward such that it could become caught by other objects, debris, or soil, and the break point feature was ineffective.

The other two cars with bottom outlet valves that opened during the derailment were GE Equipment- and Trinity-owned cars that used a bottom valve handle arrangement in which the valve handle extended out from the center of the tank and then upward and was secured to the right side of the tank. Moving the handle longitudinally from the A end toward the B end of the car opened the valve. This design does not have a breakaway feature for the valve handle, instead relying on the fact that the handle extends above the bottom surface of the skid protection plate in satisfaction of the AAR standard. Postaccident inspection of the two cars revealed that bottom outlet valve handles were bent and pulled away from their retaining brackets and that the exposed ball valves were open, thus allowing release of lading through the sheared nozzles.

The risks of releases from bottom outlet valves on general service tank cars has been recognized for many years, as illustrated by the Chemical Manufacturers' Association's June 7, 1994, correspondence with the NTSB concerning the status of Safety Recommendation R-91-11 in which it reported that some of its members had made voluntary equipment modifications to enhance the performance of their DOT-111 tank cars and that these modifications included eliminating bottom outlets where feasible.

The AAR Tank Car Committee task force that considered several DOT-111 protective systems or changes in operations discussed removal of bottom outlets from new and existing DOT-111 tank cars in ethanol and crude oil service. The task force concluded that although bottom outlet removal would be a significant improvement to tank car release performance and could be easily accomplished, removing the bottom fittings would have major impact on existing loading and unloading infrastructure. Therefore, AAR Circular letter CPC 1230 that includes new requirements for tank cars ordered after October 1, 2011, failed to address removal or further protection of bottom fittings.

The Hazardous Materials Regulations at 49 CFR 179.200-17(a)(4) and 173.31(d)(2) require that outlet nozzle construction ensure against the unseating of the valve and that closures on tank cars be designed and closed such that there will be no release of a hazardous material under conditions normally incident to transportation, including the effects of temperature and vibration, but the regulations are silent on the performance of bottom outlet valve operating mechanisms under accident conditions. All bottom outlet nozzles are provided with a score section around the piping or bolts that allow the nozzle to break away when struck in an accident, thus preventing the bottom outlet valve from being damaged. When the bottom outlet nozzle is stripped away by the forces of an accident, it is essential that the valve remain closed, otherwise product will be free to drain from the tank.

To prevent unintended opening of bottom outlet valves during derailments, the valve operating handles should be weak enough to readily break free before forces acting on the handle become sufficient to break the retaining pin and rotate the bottom valve to its open position. Alternatively, operating handles could be made of a detachable design such that no protruding mechanism is present that could inadvertently open the bottom outlet valve during an accident. The NTSB therefore concluded that the existing standards and regulations for the protection of bottom outlet valves on tank cars do not address the valves' operating mechanisms and therefore are insufficient to ensure that the valves remain closed during accidents. The NTSB therefore recommends that PHMSA require that all bottom outlet valves used on newly manufactured and

existing non-pressure tank cars are designed to remain closed during accidents in which the valve and operating handle are subjected to impact forces.

Design Requirements for Hazardous Materials Tank Cars

One of the derailed tank cars in this accident had a large breach that occurred as the draft sill was loaded downward relative to the tank. The draft sill is attached to pads that are attached to the tank car. The pads should help protect the tank from fracture caused by loads applied to the draft sill. The strength of the welds attaching the draft sill to the pad should be no more than 85 percent of the strength of the welds attaching the pad to the tank. Thus, it is expected that the draft sill should separate from the pad before the pad separates from the tank. However, in the case of this particular tank car, the front sill pad fractured from the tank and remained attached to the draft sill.

The fracture of the front sill pad occurred at its edges within the fillet welds where it was attached to the tank. Overall deformation and fracture patterns indicated fracture initiated at the front edge of the front sill pad due to downward loading of the head brace relative to the tank. Fractures at the edges of the front sill pad all showed ductile overstress features with no evidence of preexisting damage such as weld defects or fatigue cracks.

As the draft sill deformed further downward during the accident sequence, the front sill pad separated completely from the tank, but the body bolster pad remained attached to the tank, and the draft sill remained attached to the body bolster pad. As a result, the downward deformation of the draft sill led to a circumferential rupture of the tank shell adjacent to the front edge of the body bolster pad.

AAR standards require that the pads extend at least 1 inch transversely on either side of the draft sill attachment and must extend some distance from the head brace in the longitudinal direction as defined by a formula. However, there is no other requirement for distance that the pads extend in the longitudinal direction. In the tank cars involved in this accident, transverse portions of the draft sill attachment above the center plate were welded to the body bolster pad adjacent to the edge of the bolster pad where the pad was welded to the tank. This area also corresponded to the tank circumferential fracture location. While separation of the front sill pad made tank failure more likely, the proximity of the attachment welds for the pads and the draft sill in this area provided a location where draft sill loads could be transferred directly to the tank wall rather than going first through the pads.

According to AAR standards for other substantial attachments such as brackets (AAR MSRP C-III Appendix E 15.2.4), the distance between a bracket and the edge of the pad shall not be less than three times the thickness of the pad in any direction. However, there is no similar requirement for draft sills in the longitudinal direction except between the head brace and the front edge of the front sill pad. The NTSB concluded that tank car design standards for the attachments of draft sills to sill pads and of sill pads to the tanks are insufficient to protect the integrity of the tanks in accidents in which the draft sills are subjected to significant downward deformation. The NTSB believes that the requirements for draft sills should be reviewed to ensure that appropriate distances are maintained between the draft sill/pad attachment welds and the pad/tank welds in all directions throughout the entire length of the draft sill attachment. The NTSB has issued the following safety recommendation to the AAR:

> Review the design requirements in the Association of American Railroads *Manual of Standards and Recommended Practices* C-III, "Specifications for Tank Cars for Attaching Center Sills or Draft Sills," and revise those requirements as needed to ensure that appropriate distances between the welds attaching the draft sill to the reinforcement pads and the welds attaching the reinforcement pads to the tank are maintained in all directions in accidents, including the longitudinal direction. (R-12-9)

The revised AAR standard would address tank cars constructed after the changes are published and would not be expected to require retrofitting of the tank car fleet existing at the time the changes are published. Given the estimated tank car service life of 30 to 40 years, this represents the potential for tank cars with susceptibility to tank failure from loads applied to the draft sill to exist long after changes are made to the design standards.

Therefore, the NTSB recommends that PHMSA require that all newly manufactured and existing tank cars authorized for transportation of hazardous materials have center sill or draft sill attachment designs that conform to the revised Association of American Railroads' design requirements adopted as a result of Safety Recommendation R-12-9.

Pipeline Damage

At the site of the derailment was a 12-inch-diameter underground natural gas transmission pipeline operated by Nicor Gas. The pipeline exceeded Federal standards for protective ground cover by a factor of 3. It was also five times as deep as the industry-recommended protection requirement for depth of cover that was in effect at the time the pipeline was constructed. Yet, as the wreckage was removed from above the pipeline, Nicor's crews discovered that a railcar wheel and axle assembly had impinged on the pipeline. Although the pipeline was buried about 11 feet deep and protected within a 16-inch-diameter casing, the rail car wheels impacted and severely dented the pipeline. The impact caused a severe flattening of the pipe casing with sharp angular bends at two locations where it was contacted by the rail car wheel assembly. This degree of deformation to the 16-inch casing pipe likely caused similar damage to the 12-inch carrier pipe. The NTSB concluded that had the gas pipeline been installed at the railroad crossing with the minimum level of ground cover permitted by the current Federal and industry pipeline construction standards, it likely would have failed as a result of being struck by derailed equipment in this accident.

Although the pipeline did not leak as a result of this accident, even minor dents and nicks are capable of causing pipeline failures. Pipeline damage caused by an accident may result in a catastrophic pipeline failure that occurs some period of time after the damage was inflicted, as was the case following the derailment of a Southern Pacific Transportation Company freight train on May 12, 1989, in San Bernardino, California.[14] Thirteen days after the derailment in San Bernardino, a 14-inch pipeline at the derailment site ruptured, released gasoline, and ignited. The San Bernardino pipeline failure and subsequent fire resulted in 2 fatalities and 19 injuries and

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[14] *Derailment of Southern Pacific Transportation Company Freight Train on May 12, 1989 and Subsequent Rupture of Calnev Petroleum Pipeline on May 25, 1989, San Bernardino, California*, Railroad Accident Report NTSB/RAR-90/02 (Washington, DC: National Transportation Safety Board, 1990). <http://:www.ntsb.gov>

illustrates the potential outcome had a release occurred at the Cherry Valley, Illinois, derailment site.

PHMSA research found only five reportable incidents[15] since 1984 in which a train derailment caused damage to pipelines crossing under the tracks. Although PHMSA does not collect data that would reflect the number of incidents in which pipelines are damaged by train derailments at locations in railroad rights-of-way other than crossings, the aforementioned San Bernardino pipeline failure illustrates that buried pipelines can be damaged when present near railroad accident scenes. Despite the infrequency of such incidents, the NTSB believes that pipeline operators and railroad companies should be informed about the potential risk of damages to pipelines whenever a train derails. Given the prevalence both of underground pipelines and aboveground railroad tracks, the two must, of necessity, cross at numerous locations. Responsible pipeline operators may wish to consider protection methods that offer a higher level of safety when installing pipelines at these critical locations. The NTSB therefore recommends that PHMSA inform pipeline operators about the circumstances of the accident and advise them of the need to inspect pipeline facilities after notification of accidents occurring in railroad rights-of-way.

Accuracy of Train Consist Information

The original consist for the accident train had only 3 of the 76 cars in their proper positions on the train. This was not the first instance in which the CN failed to comply with 49 CFR 174.26, "Notice to Train Crews," which requires that a train crew have a train consist that accurately reflects the current position of each rail car containing hazardous material in a train. In a July 10, 2005, accident in Anding, Mississippi,[16] in which one of the train consists was destroyed in the collision of two freight trains, the CN subsequently delivered an inaccurate consist that caused confusion during the emergency response. During the FRA's 2006 national hazardous materials audit focusing on the level of compliance with hazardous materials communications, it also found that 22.3 percent of the CN trains audited had improper hazardous materials car documentation, consist errors, train crews failing to update the train consist to reflect actual car placement, or trains dispatched with erroneous consist information.

In this accident, because the tank cars of the accident train made up a unit train consisting of a single commodity, no confusion occurred as a result of the train crew's failure to update the train consist. If different hazardous commodities had been commingled in the train, emergency responders would have been unable to locate them based upon the train consist. The NTSB therefore concluded that the inaccurate train consist carried by the crew did not affect the emergency response to this accident; however, had a mixture of hazardous commodities been involved, the inaccurate consist information could have hampered the response effort or put the safety of emergency responders and others at risk.

Electronic transmission of shipping paper information did occur in this accident, albeit about 3 hours after the train crew provided emergency responders with an inaccurate paper document, and about 4 hours after the dispatcher orally conveyed hazardous materials

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[15] Damage to the pipeline that does not involve the release of gas is not necessarily reported.

[16] *Collision of Two CN Freight Trains Anding, Mississippi July 10, 2005*, Railroad Accident Report NTSB/RAR-07/01 (Washington, DC: National Transportation Safety Board, 2007). <www.ntsb.gov>

information to the fire department. When first contacted about the accident about 9:15 p.m. on the day of the accident, the CN could have at that time faxed or e-mailed the correctly ordered train car consist directly to incident command. Since this accident, the CN has provided its emergency responders with the capability, through e-mail, to receive the train consist, hazardous materials waybills, and material safety data sheets. Accuracy of the train consist information would be ensured through automatic equipment identification readers that relay train consist data to the CN's central computer. With this increased use of technology, remote access to the CN's database should ensure that updated train car consist and hazardous materials information is available to emergency response personnel at accident scenes in a more timely manner.

As a result of its investigation of the Anding, Mississippi, train collision, the NTSB recommended that the FRA (Safety Recommendation R-07-2) and PHMSA (Safety Recommendation R-07-4) work together to develop PHMSA regulations requiring that railroads immediately provide to emergency responders accurate, real-time information about the identity and location of all hazardous materials on a train.

PHMSA, in a January 22, 2008, response to Safety Recommendation R-07-4, indicated to the NTSB that it was examining (1) ways to improve the availability of accurate and immediate information for emergency responders on the scene of an accident, and (2) strategies for enhancing emergency response planning and training efforts. Additionally, PHMSA indicated that it was evaluating the emergency response issues raised in the safety recommendation and the Federal, state, and local government, and industry programs intended to address those issues. Based on this response, the NTSB classified Safety Recommendation R-07-4 "Open—Acceptable Response."

In an October 10, 2007, response to Safety Recommendation R-07-2, the FRA noted the ongoing efforts of the AAR, CHEMTREC,[17] and the American Short Line and Regional Railroad Association to enhance the availability of hazardous materials information during an accident. But the FRA maintained that the current practice of requiring the physical hand-off of train consists and other hazardous materials information "remains the most accurate method of transferring this information when an accident occurs." The FRA stated that it had no reason to believe that regulatory revisions are necessary to address this issue.

In an April 12, 2011, follow-up response to the safety recommendation, the FRA noted that its regulations require that information on the identity and location of hazardous materials shipments on a train be maintained by a member of the train crew for the benefit of emergency responders. Further, with the FRA's encouragement, the AAR issued a circular offering to provide hazardous materials information on the top 25 commodities to local emergency response organizations to assist in training and preparing for emergencies. Finally, with the FRA's encouragement, CSX Transportation, Inc., and CHEMTREC established a real-time information process that provides car content and train consist information on a "one-call" basis. The FRA indicated that it continues to evaluate this process to determine if additional regulations are necessary.

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[17] CHEMTREC (the Chemical Transportation Emergency Center), is an around-the-clock service available to firefighters, law enforcement officials, and other emergency responders who need immediate response information for emergency incidents involving chemicals, hazardous materials, and dangerous goods.

While acknowledging the activities and contributions of the AAR, CHEMTREC, and industry stakeholders to facilitate the rapid communication of hazardous materials information, in a January 10, 2011, letter, the NTSB reminded the FRA that the intent of Safety Recommendation R-07-2 was to require railroads to provide to emergency responders information about the identity and location of hazardous materials on a train at the time of an accident and that the FRA had not identified any initiatives it had taken to move this recommendation forward. Therefore, the NTSB continues to classify Safety Recommendation R-07-2 "Open—Unacceptable Response."

The NTSB also supports the HM-ACCESS initiative of PHMSA, which will allow the electronic communication of shipping paper information and improve the availability and accuracy of hazard communications to emergency responders. If implemented as envisioned, railroads will be able to quickly transmit electronically updated and accurate train consist data to emergency responders when accidents occur.

However, PHMSA began its HM-ACCESS initiative with public meetings on October 13–14, 2009, to discuss an upcoming proof-of-concept study on the use of electronic documents for hazardous materials shipments, no rulemaking has been initiated by PHMSA or the FRA to require railroads to immediately provide accurate consist information to emergency responders. Therefore, the NTSB reiterates Safety Recommendations R-07-2 and R-07-4 to the FRA and PHMSA, respectively.

The National Transportation Safety Board makes the following safety recommendations to the Pipeline and Hazardous Materials Safety Administration:

> Require that all newly manufactured and existing general service tank cars authorized for transportation of denatured fuel ethanol and crude oil in Packing Groups I and II have enhanced tank head and shell puncture resistance systems and top fittings protection that exceeds existing design requirements for DOT-111 tank cars. (R-12-5)
>
> Require that all bottom outlet valves used on newly manufactured and existing non-pressure tank cars are designed to remain closed during accidents in which the valve and operating handle are subjected to impact forces. (R-12-6)
>
> Require that all newly manufactured and existing tank cars authorized for transportation of hazardous materials have center sill or draft sill attachment designs that conform to the revised Association of American Railroads' design requirements adopted as a result of Safety Recommendation R-12-9. (R-12-7)
>
> Inform pipeline operators about the circumstances of the accident and advise them of the need to inspect pipeline facilities after notification of accidents occurring in railroad rights-of-way. (R-12-8)

Based on its findings in this accident investigation, the National Transportation Safety Board reiterates the following previously issued safety recommendation to the Pipeline and Hazardous Materials Safety Administration:

> With the assistance of the Federal Railroad Administration, require that railroads immediately provide to emergency responders accurate, real-time information regarding the identity and location of all hazardous materials on a train. (R-07-4)

The NTSB also issued safety recommendations to the U.S. Department of Transportation, the Federal Railroad Administration, to the Association of American Railroads, to the American Association of State Highway and Transportation Officials, to the National Association of County Engineers, to the American Public Works Association, to the Institute of Transportation Engineers, to the National League of Cities, to the National Association of Counties, to the Association of State Dam Safety Officials, to the National Association of Towns and Townships, to the U.S. Conference of Mayors, and to the Canadian National Railway Company. The NTSB also reiterated a previously issued safety recommendation to the Federal Railroad Administration.

In response to the recommendations in this letter, please refer to Safety Recommendations R-12-5 through -8 and R-07-4. We encourage you to submit updates electronically at the following e-mail address: correspondence@ntsb.gov. If a response includes attachments that exceed 5 megabytes, please e-mail us at the same address for instructions. To avoid confusion, please do not submit both an electronic copy and a hard copy of the same response.

Chairman HERSMAN, Vice Chairman HART, and Members SUMWALT, ROSEKIND, and WEENER concurred in these recommendations.

[Original Signed]

By: Deborah A.P. Hersman
Chairman

NewsRoom

1/24/14 N.Y. Times B3
2014 WLNR 2103942

New York Times (NY)

January 24, 2014

Section: B

U.S. and Canada Urge New Safety Rules for Crude Oil Rail Shipments

JAD MOUAWAD and IAN AUSTEN

In a joint move that highlighted growing concerns about the safety of crude oil transportation by rail, officials from the United States and Canada issued a series of recommendations on Thursday, including that oil-laden trains avoid populated and sensitive areas.

The recommendations, by the National Transportation Safety Board and the Transportation Safety Board of Canada, follow several catastrophic accidents and derailments of trains carrying crude oil in the last year, including one that killed 47 people last July in Lac-Mégantic, Quebec.

According to these recommendations, oil carried on trains should be treated the same way as other dangerous materials like explosives or toxic materials. In those cases, rail carriers perform a more detailed security and safety analysis and look for alternative routes to avoid highly populated areas, iconic buildings, landmarks or environmentally sensitive regions.

Railroads should also be required to develop spill-response plans similar to those that are required from pipeline operators, the recommendations said. Those plans would help emergency workers and could help reduce the impact of any spill. In addition, the safety officials also recommended making sure that hazardous cargo was properly classified. Investigators looking into the Lac-Mégantic accident found that the crude oil in transit had been mislabeled into a less hazardous category.

Crude oil shipments by rail have soared in recent years, mostly because of the rapid rise in production from the Bakken shale region, which straddles North Dakota, Montana, Saskatchewan and Manitoba, as well as from Canada's oil sands. Because of a lack of pipelines there, energy companies have turned to railroads to move their supplies to refineries.

"The large-scale shipment of crude oil by rail simply didn't exist 10 years ago, and our safety regulations need to catch up with this new reality," said Deborah A. P. Hersman, the United States safety board's chairwoman. "This is a huge change in what is being transported, and how it is being transported."

The safety board's recommendations to the Federal Railroad Administration and the Pipeline and Hazardous Materials Safety Administration, both part of the Department of Transportation, are not binding. But they have been made as regulators and industry officials have come under increasing pressure to improve safety standards. Last week, railroad executives met with transportation officials in Washington, including Anthony Foxx, the transportation secretary, and pledged to review safety

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procedures within 30 days. Among the measures being considered, Mr. Foxx said at the time, are ways to reroute crude oil trains around large cities.

The Transportation Department said it was looking at all measures to ensure the safe transport of oil. Regulators have already been investigating the proper classification of crude shipments and said that more measures would be announced in coming weeks.

Some experts said that rerouting trains was not as straightforward or practical as it sounded.

"It is very difficult in many places because towns are often built around the main rail line, and there are not many alternatives around it," said Brigham A. McCown, a former administrator of the Pipeline and Hazardous Materials Safety Administration. "And an alternative route might be twice as long and subject to other difficulties."

Canadian officials said that when rerouting was not practical or possible, railways should limit the size of trains carrying flammable liquids and reduce their speed. Safety officials in both countries also repeated their warnings about the type of tank cars, known as DOT-111s in the United States, that are used to carry crude oil and ethanol. Past investigations found that these tank cars do not provide sufficient protections in case of derailment and are prone to break or puncture too easily.

But the United States and Canada have largely avoided taking effective action despite warnings for about 20 years. Oil trains derailed in Alabama in November and in North Dakota last month, though no one was injured. In both cases, there were large explosions after the tank cars ruptured and spilled large quantities of oil.

"Derailments are not unusual, but what we have now is a very different commodity, and very different risk," Ms. Hersman said in an interview. "These are high-consequence events. So far, we've had a lot of talk. We need to see action."

The large death toll and incineration last summer in Lac-Mégantic has created widespread unease in Canada, and made further inaction politically difficult.

"Clearly based on the science in Lac-Mégantic, these materials should not be carried in class 111 tank cars," Wendy A. Tadros, chairwoman of the Transportation Safety Board of Canada, said in Ottawa Thursday. In a statement, Lisa Raitt, Canada's minister of transport, who is ultimately responsible for railroad regulation, said she had told her department, Transport Canada, "to review the recommendations on an urgent basis."

Removing or replacing older tank car models is also likely to be hard. The rail industry has proposed new standards for cars built after 2011 and regulators in the United States are reviewing what to do with the older models.

In Canada, Ms. Tadros declined to propose a specific deadline for the removal of the older tank cars, saying that was an issue for Transport Canada and the industry to resolve. The agency estimates that 228,000 of the cars are in use on North American railways.

"We know it can't be done tomorrow," she said, but added, "A long and gradual phaseout of older model cars simply isn't good enough."

PHOTO: A train carrying crude oil derailed and exploded in Lac-Mégantic, Quebec, in July, killing 47. (PHOTOGRAPH BY MATHIEU BELANGER/REUTERS)

---- Index References ----

Industry: (Americas Crude Oil (1AM35); Canada Crude Oil (1CA34); Crude Oil (1CR88); Downstream Oil (1DO72); Energy & Fuel (1EN13); Land Transportation (1LA43); Oil & Gas (1OI76); Oil & Gas Pipeline (1OI68); Oil Pipelines (1OI49); Passenger Railroads (1PA89); Passenger Transportation (1PA35); Railroads (1RA98); Refined Oil Products (1RE10); Transportation (1TR48); U.S. Crude Oil (1US90))

Region: (Americas (1AM92); Canada (1CA33); North America (1NO39); North Dakota (1NO56); U.S. Midwest Region (1MI19); USA (1US73))

Language: EN

Other Indexing: (MATHIEU BELANGER; Deborah Hersman; Anthony Foxx; Wendy Tadros; Lisa Raitt; Brigham McCown)

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End of Document

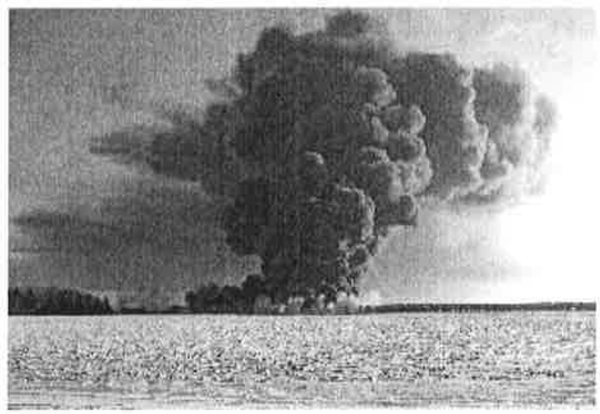
StarTribune

NTSB: 400,000 gallons of crude spilled in Casselton train wreck

Article by: DAVID SHAFFER and EVAN RAMSTAD
Star Tribune staff writers
January 13, 2014 - 9:08 PM

FILE - In this Tuesday, July 9, 2013 file photo, workers comb through debris after a train derailed three days earlier causing explosions of railway cars carrying crude oil in Lac-Megantic, Quebec.

Paul Chiasson, Associated Press



This photo provided by Cass County Commissioner Ken Pawluk shows a train derailment and fire west of Casselton, N.D., Monday, Dec. 30, 2013.

Associated Press ,

The oil train that crashed and burned after colliding with a derailed train near Casselton, N.D., on Dec. 30 spilled 400,000 gallons of crude, U.S. investigators said Monday in a preliminary report on the accident.

The two BNSF Railway Co. trains were traveling well under the permitted speed on parallel tracks outside Casselton, said the report from the National Transportation Safety Board (NTSB).

NTSB investigators offered no conclusion about why the westbound grain-bearing train derailed. Final reports on the agency's investigations typically take months.

U.S. Sen. Amy Klobuchar, D-Minn., on Monday called for a separate inquiry by the Senate Transportation Committee focused on tank car standards. She said the committee should review recent oil train explosions, including the North Dakota crash and an accident last July in Lac Mégantic, Quebec, that killed 47 people and incinerated part of the town. She also wants to look into the Dec. 5 derailment of a Canadian National iron ore train in Two Harbors, Minn., in which two workers were injured.

In a letter to committee Chairman John Rockefeller, D-W.Va., Klobuchar said the recent crashes "have raised concerns even among those very Americans who depend on rail for jobs, commerce and transport." Klobuchar serves on the committee.

North Dakota, now the No. 2 oil-producing state behind Texas, lacks sufficient pipelines to carry away its growing Bakken region output. More than two-thirds of the state's crude oil is shipped by rail, and many of the 100-tanker oil trains past through the Twin Cities on BNSF and Canadian Pacific tracks.

North Dakota Gov. Jack Dalrymple on Monday expressed support for more-stringent standards for tank cars. Last week, the state's three-member congressional delegation also urged federal regulators to move quickly to address safety issues.

"It's very clear that we need tank cars with improved safety features for the transportation of Bakken crude oil," Dalrymple said in a statement after speaking to BNSF CEO Matt Rose about rail safety.

Safety appeal ignored

After a deadly 2009 ethanol train crash and fire in Illinois, the NTSB recommended upgrading rail tank cars to make them more resistant to punctures and to improve other safety features. But the U.S. Pipeline and Hazardous Materials Safety Administration has not yet proposed regulations to address those concerns.

In the preliminary report on the North Dakota accident, the NTSB said the eastbound train with 106 oil tankers collided with a derailed car from the grain train that had landed on the eastbound track.

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The oil train had been traveling at 43 miles per hour and struck the derailed car at 42 mph, the report said. The speed limit for freight trains in that area is 60 mph.

The grain train was traveling at 28 mph when its emergency brakes were engaged, but the report did not say whether that happened before or during its derailment.

The collision sent the oil train's two locomotives and 21 other cars, including 20 tankers, off the tracks.

Eighteen of the tankers were punctured and some exploded in fireballs that were visible for miles. Authorities evacuated 1,400 residents of Casselton as a precaution. No one was injured, including crew members from both trains who sprinted away before the explosions.

The NTSB estimated damage from the accident at $6.1 million. The trains were cleared and traffic resumed on the tracks near Casselton, 20 miles west of Fargo, on Jan. 2.

The NTSB said it had taken a broken axle and two wheels from the accident to Washington for deeper analysis, but it didn't specify from which train the parts came.

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NTSB Press Release

National Transportation Safety Board
Office of Public Affairs

NTSB calls for tougher standards on trains carrying crude oil

January 23

The National Transportation Safety Board today issued a series of recommendations (see Safety Recommendation Letters R-14-001-003 and R-14-004-006) to the Department of Transportation to address the safety risk of transporting crude oil by rail. In an unprecedented move, the NTSB is issuing these recommendations in coordination with the Transportation Safety Board of Canada.

Crude oil shipments by rail have increased by over 400 percent since 2005, according to the Association of American Railroad's Annual Report of Hazardous Materials. The NTSB is concerned that major loss of life, property damage and environmental consequences can occur when large volumes of crude oil or other flammable liquids are transported on a single train involved in an accident, as seen in the Lac Megantic, Quebec, accident, as well as several accidents the NTSB has investigated in the U.S.

"The large-scale shipment of crude oil by rail simply didn't exist ten years ago, and our safety regulations need to catch up with this new reality," said NTSB Chairman Deborah A.P. Hersman. "While this energy boom is good for business, the people and the environment along rail corridors must be protected from harm."

The NTSB issued three recommendations to the Federal Railroad Administration and the Pipeline and Hazardous Materials Safety Administration, the first would require expanded hazardous materials route planning for railroads to avoid populated and other sensitive areas.

The second recommendation to FRA and PHMSA is to develop an audit program to ensure rail carriers that carry petroleum products have adequate response capabilities to address worst-case discharges of the entire quantity of product carried on a train.

The third recommendation is to audit shippers and rail carriers to ensure that they are properly classifying hazardous materials in transportation and that they have adequate safety and security plans in place.

The NTSB has investigated accidents involving flammable liquids being transported in DOT-111 tank cars, including the Dec. 30, 2013, derailment in Casselton, ND, and the June 19, 2009, derailment in Cherry Valley, IL. After the Cherry Valley accident, the NTSB issued several safety recommendations to PHMSA regarding the inadequate design and poor performance of the DOT-111 tank cars. The recommendations include making the tank head and shell more puncture resistant and requiring that bottom outlet valves remain closed during accidents. Although PHMSA initiated rulemaking to address the safety issue; it has not issued any new rules.

"If unit trains of flammable liquids are going to be part of our nation's energy future, we need to make sure the hazardous materials classification is accurate, the route is well planned, and the tank cars are as robust as possible," Hersman said.

The NTSB and the Transportation Safety Board of Canada issued these important safety recommendations jointly because railroad companies routinely operate crude oil unit trains in both countries and across the U.S-Canada border.

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The National Transportation Safety Board (NTSB) is an independent federal agency charged with determining the probable cause of transportation accidents, promoting transportation safety, and assisting victims of transportation accidents and their families.

EXHIBIT D

Accident Dockets
Training Center
Safety Recommendations
Strategic Plan, Performance & Accountability Reports & More
Media Resources
Report an Accident
Submit a TCAS Notification

Directions to Conference Center
Board Members
Contact Us
Employment
Web Policies & Notices

FAQs
FOIA
No Fear
Privacy Statement
Open.gov

National Transportation Safety Board
Washington, DC 20594

Safety Recommendation

Date: January 21, 2014

In reply refer to: R-14-4 through -6

The Honorable Cynthia L. Quarterman
Administrator
Pipeline and Hazardous Materials
Safety Administration
Washington, DC 20590

The National Transportation Safety Board (NTSB) is providing the following information to urge the Pipeline and Hazardous Materials Safety Administration (PHMSA) to take action on the safety recommendations issued in this letter. These recommendations are derived from the NTSB's participation in the Transportation Safety Board of Canada's (TSB) investigation of the July 6, 2013, derailment of a Montreal, Maine & Atlantic (MMA) freight train in Lac-Mégantic, Quebec, Canada.

These recommendations address hazardous materials route analysis and selection, oil spill prevention and response plans, and identification and classification of hazardous materials in railroad freight transportation. As a result of this investigation to date, and consistent with the evidence found and the observations made, the NTSB is issuing three safety recommendations to PHMSA. Information supporting these recommendations is discussed below.

The Accident

On July 5, 2013, at 10:45 p.m. eastern daylight time, MMA freight train MMA-002 was proceeding eastbound on the MMA Sherbrooke Subdivision, en route from Montréal, Quebec, to Saint John, New Brunswick, Canada. The train was 4,700 feet long and weighed more than 10,000 tons. The train was composed of 5 head-end locomotives, a special-purpose caboose equipped to remotely control the locomotives, 1 loaded boxcar used as a buffer car, and 72 US Department of Transportation (DOT) Specification 111 general service tank cars (DOT-111) loaded with petroleum crude oil. The waybills described the product in the tank cars as Petroleum Crude Oil, UN1267, Class 3, Packing Group III. The crude oil originated from a tank truck-to-rail car transloading facility in New Town, North Dakota, and was destined for an oil refinery in Saint John, New Brunswick. The Canadian Pacific Railway transported the tank cars from New Town to Montréal, where the train was conveyed to the MMA with the same waybill information.

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About 11:00 p.m., the engineer stopped the train at the designated MMA crew change point at milepost 7.40 near Nantes, Quebec. He left the lead locomotive idling and then departed the area, leaving the train unattended on the mainline track. The track had a descending grade of about 1.2 percent toward the town of Lac-Mégantic.

About 11:40 p.m., a nearby resident called the 911 emergency call center to report a fire on the idling locomotive. The local fire department responded, and the MMA dispatched an employee to assist the fire department personnel. About midnight, the responders initiated emergency shutdown procedures on the locomotive and extinguished the fire. The fire department and MMA personnel then departed the location, leaving the train unattended.

Shortly before 1:00 a.m. on July 6, 2013, the unattended train started to move, and it gathered speed, rolling uncontrolled for 7.4 miles down the descending grade into Lac-Mégantic. As the train entered the center of Lac-Mégantic, it was moving well over the authorized speed. The boxcar and 63 loaded crude oil tank cars derailed near the center of Lac-Mégantic. The locomotives separated from the train and came to rest about 1/2 mile east of the derailment.

At least 60 of the 63 derailed DOT-111 tank cars released about 1.6 million gallons of crude oil. Some of the spilled oil ignited immediately. The fire engulfed the derailed cars and the surrounding area. Forty-seven people died as a result of the fire, and nearby structures were destroyed or extensively damaged. The fire was extinguished by noon on July 7, 2013. About 2,000 people evacuated the surrounding area.

DOT Postaccident Actions

On August 2, 2013, the Federal Railroad Administration (FRA) issued Emergency Order No. 28 to address safety issues related to securement of unattended trains containing the following:

> (1) five or more tank car loads of any one or any combination of materials poisonous by inhalation as defined in Title 49 *Code of Federal Regulations* (CFR) 171.8, and including anhydrous ammonia (UN1005) and ammonia solutions (UN3318); or (2) 20 rail car loads or intermodal portable tank loads of any one or any combination of materials listed in (1) above, or, any Division 2.1 flammable gas, Class 3 flammable liquid or combustible liquid, Class 1.1 or 1.2 explosive, or hazardous substance listed in 49 CFR 173.31(f)(2).[1]

These quantities of specific hazardous materials addressed in Emergency Order No. 28 are the same as those that define a key train[2] as outlined in the Association of American Railroads (AAR) Circular No. OT-55-N, *Recommended Railroad Operating Practices for Transportation of Hazardous Materials,* effective August 5, 2013. Emergency Order No. 28 "was intended to address some of the human factors failures that may cause unattended equipment to be

[1] *Federal Register* 78, no. 152 (August 7, 2013): 48218.

[2] The Association of American Railroads revised the definition of *key train* on August 5, 2013, to mean "any train with one tank car load of Poison or Toxic Inhalation Hazard (Hazard Zone A, B, C, or D), anhydrous ammonia (UN1005), or ammonia solutions (UN3318); 20 car loads or intermodal portable tank loads of any combination of hazardous material; or one or more car loads of spent nuclear fuel or high level radioactive waste."

improperly secured and to protect against a derailment situation similar to that which occurred in Lac-Mégantic."

Emergency Order No. 28 prohibits railroads from leaving trains or vehicles transporting the specified hazardous materials unattended on mainline track or siding outside of a yard or terminal unless the railroad adopts and complies with a plan that provides sufficient justification for leaving them unattended under specific circumstances and locations. The order also requires railroads to develop specific processes for securing, communicating, and documenting the securement of applicable unattended trains and vehicles, including locking the controlling locomotive cab door or removing the reverser[3] and setting a sufficient number of hand brakes before leaving the equipment unattended. In addition, the order requires railroads to review, verify, and adjust as necessary existing requirements and instructions related to the number of hand brakes to be set on unattended trains; conduct train securement job briefings among crewmembers and employees; and develop procedures to ensure qualified employees inspect equipment for proper securement after emergency response actions that involve the equipment.

The NTSB agrees with the following safety concerns arising from the Lac-Mégantic accident the FRA identified in Emergency Order No. 28:

- Crude oil is problematic when released because it is flammable, and the risk is compounded because it is commonly shipped in large units.
- Similar dangers exist with other hazardous materials such as ethanol, which was transported via rail more than any other hazardous material in 2012.
- Although the Lac-Mégantic accident occurred in Canada, the freight railroad operating environment in Canada is similar to that in the United States.
- The MMA train in the Lac-Mégantic accident was transporting 72 carloads of petroleum crude oil in a single consist. Rail lines in the United States commonly configure trains to transport crude oil by a unit train that consists virtually entirely of tank cars containing crude oil.

On August 2, 2013, PHMSA and the FRA issued joint Safety Advisory 2013-06.[4] The advisory recommends eight additional actions that railroads and shippers should take to ensure the safe transportation of hazardous materials:

- Review the details and lessons learned from the Lac-Mégantic accident;
- Review crew staffing levels;
- Require the train reverser to be removed and secured when unattended;
- Review all railroad operating procedures, testing, and operating rules concerning train securement;

[3] The *reverser* is the directional control for the locomotive. Removing it would put the locomotive in neutral, preventing it from moving forward or backward under power of the engine.

[4] *Federal Register* 78, no. 152 (August 7, 2013): 48224.

- Review the Transport Canada[5] directives to secure and safely operate a train;
- Conduct a systemwide assessment of security risks when a train is unattended and identify mitigation efforts for those risks;
- Evaluate processes to ensure proper classification of hazardous materials for shipment; and
- Review shippers' and carriers' safety and security plans and amend the plans as necessary.

DOT-111 Tank Cars

The NTSB recognizes that rail shipments of crude oil have sharply increased in recent years as the United States experiences unprecedented growth in oil production,[6] and the Lac-Mégantic accident demonstrates that major loss of life, property damage, and environmental consequences can occur when large volumes of crude oil or other flammable materials are on a train involved in an accident. The potential destructive effects of large numbers of derailed DOT-111 tank cars containing flammable materials are further demonstrated by several recent NTSB accident investigations:

- The December 30, 2013, BNSF Railway Company crude oil unit train that derailed near Casselton, North Dakota, after striking another derailed freight train. Several of the DOT-111 tank cars ruptured and released product that ignited. The postaccident fire destroyed two locomotives and thermally damaged several additional tank cars causing violent, fiery eruptions. Dense, toxic smoke forced a temporary evacuation of the town.
- The July 11, 2012, Norfolk Southern Railway Company train derailment in a Columbus, Ohio, industrial area in which three derailed DOT-111 tank cars released about 53,000 gallons of ethanol, with energetic rupture of one tank car in a postaccident fire.
- The October 7, 2011, derailment in Tiskilwa, Illinois, of 10 DOT-111 tank cars resulting in fire, energetic rupture of several tank cars, and the release of 162,000 gallons of ethanol.[7]

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[5] *Transport Canada* is the Canadian government department responsible for regulating transportation safety in Canada.

[6] Bureau of Explosives, *Annual Report of Hazardous Materials Transported by Rail*, BOE 12-1 (Washington, DC: Association of American Railroads, Bureau of Explosives, 2013).

[7] National Transportation Safety Board, *Derailment and Hazardous Materials Release and Fire, Tiskilwa, Illinois, October 7, 2011*, RAB-13/02 (Washington DC: National Transportation Safety Board, 2013).

- The June 19, 2009, Canadian National Railway derailment in Cherry Valley, Illinois, in which 13 of 19 derailed DOT-111 tank cars were breached, caught fire, and released about 324,000 gallons of ethanol. The postaccident fire resulted in one death, nine injuries, and the evacuation of 600 houses within 1/2 mile of the accident.[8]
- The October 20, 2006, derailment in New Brighton, Pennsylvania, in which 23 DOT-111 tank cars in a unit train derailed, fell from a bridge, caught fire, and released more than 485,000 gallons of ethanol.[9]

The NTSB is aware that the FRA investigated the February 6, 2011, derailment in Arcadia, Ohio, of a unit train of DOT-111 tank cars that released about 786,000 gallons of ethanol from 32 derailed tank cars. The FRA also investigated the August 5, 2012, derailment of 18 DOT-111 tank cars of ethanol in Plevna, Montana, where 5 cars caught fire, resulting in some explosions. Most recently, the FRA is investigating the November 7, 2013, derailment of 26 tank cars of a 90-car unit train of crude oil in Aliceville, Alabama, in which breached tank cars caught fire and released crude oil into a wetland.

Planning Requirements for Rail Transportation of Hazardous Materials

Title 49 CFR, Part 172, Subpart I, prescribes the requirements for the development and implementation of plans to address security risks related to the commercial transportation of hazardous materials. On November 26, 2008, PHMSA, in coordination with the FRA and the Transportation Security Administration (TSA), issued a final rule requiring, among other things, that rail carriers compile annual data on certain shipments of explosive, toxic by inhalation, and radioactive materials; use the data to analyze safety and security risks along rail routes where those materials are transported; assess alternative routing options; and make routing decisions based on those assessments. The final rule also addresses section 1551(e) of the Implementing Recommendations of the 9/11 Commission Act of 2007, Pub. L. 110-53, that requires rail carriers transporting "security sensitive materials" to select the safest and most secure route to be used in transporting those materials, based on the carrier's analysis of the safety and security risks on primary and alternative transportation routes over which the carrier has authority to operate.

Route planning and route selection requirements have been incorporated into the Hazardous Materials Regulations at 49 CFR 172.820. The regulation requires that a rail carrier that transports more than 5,000 pounds of a Division 1.1, 1.2, or 1.3 explosive in a single car load; a single bulk package of a material toxic by inhalation; or a highway route-controlled quantity of a Hazard Class 7, radioactive material, must annually compile commodity data to identify routes on which these materials are transported. The rail carrier also must annually analyze the safety and security risks for the transportation routes to include 27 risk factors, such

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[8] National Transportation Safety Board, *Derailment of CN Freight Train U70691-18 With Subsequent Hazardous Materials Release and Fire, Cherry Valley, Illinois, June 19, 2009*, RAR-12/01 (Washington DC: National Transportation Safety Board, 2012).

[9] National Transportation Safety Board, *Derailment of Norfolk Southern Railway Company Train 68QB119 with Release of Hazardous Materials and Fire, New Brighton, Pennsylvania, October 20, 2006*, RAR-08/02 (Washington DC: National Transportation Safety Board, 2008).

as the volume of hazardous materials transported; track type, class, and maintenance schedule; track grade and curvature; environmentally sensitive or significant areas; population density along the route; emergency response capability along the route; and areas of high consequence along the route as defined in 49 CFR 172.820(c). The carrier also must identify alternative routes over which it has authority to operate and perform a safety and security risk assessment of those routes for comparison. The carrier must use the analysis to select the practicable route posing the least overall safety and security risk.

According to the regulations, if the FRA finds the carrier's route selection documentation and underlying analyses to be deficient, the carrier may be required to revise the analyses or make changes in the route selection. If the FRA finds that a selected route is not the safest and most secure practicable route available, in consultation with the TSA, the FRA may require the use of an alternative route.

A primary safety and security concern related to rail transportation of hazardous materials that was considered in the interim final rule issued on April 16, 2008,[10] is the prevention of catastrophic release or explosion in proximity to densely populated areas, including urban areas and events or venues with large numbers of people in attendance, iconic buildings, landmarks, or environmentally sensitive areas. The goal of the PHMSA-required routing analysis is to ensure that each route used for the transportation of the specified hazardous materials presents the fewest overall safety and security risks. PHMSA also noted that even in the absence of alternative routes, assessing the safety and security risks along the route is critical to enhancing rail transportation safety and should prompt rail carriers to address identified vulnerabilities.

With the notable exception of the Lac-Mégantic accident, in which 47 people died and the town center was destroyed, none of the accidents cited above that involved fires and explosions on blocks of tank cars and unit trains carrying flammable materials occurred in densely populated areas. However, each of these accidents exhibited the potential for severe catastrophic outcomes had they occurred in such critical areas.

PHMSA has considered suggestions that other classes of hazardous materials, such as flammable gases, flammable liquids, hydrogen peroxide, oxidizers, poisons, and corrosives, should be included in the requirements for route selection. While evaluating the final rule, PHMSA, the FRA, and the TSA assessed the safety and security vulnerabilities associated with the transportation of different types and classes of hazardous materials based on accident scenarios and on scenarios that depict how hazardous materials could be used deliberately to cause significant casualties and property damage. In the interim final rule, the DOT and the TSA concluded the following:

> The risks are not as great as those posed by the explosive, poison inhalation hazards, and radioactive materials specified in the interim final rule, and we are not persuaded that they warrant the additional precautions required by the interim final rule.

Significant changes to the regulatory landscape have occurred since the issuance of the 2008 final rule. Major growth in crude oil and ethanol transportation volumes has occurred in

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[10] *Federal Register* 73, no. 74 (April 16, 2008): 20752.

recent years, yet this market did not exist when the rule was developed. According to the AAR *Annual Report of Hazardous Materials Transported by Rail* for 2012, crude oil shipments have increased 443 percent since 2005.[11] The first quarter of 2013 saw a 166 percent increase in crude oil shipment by rail over the first quarter of 2012, and growth is expected to continue for the foreseeable future.[12] Furthermore, in response to the US Environmental Protection Agency's 2005 Renewable Fuel Standard, ethanol traffic by railroad increased 441 percent between 2005 and 2011, and it was the most frequently transported hazardous material in 2012.

In the April 16, 2008, interim final rule, PHMSA stated that route planning and selection regulations were intended to protect against an event such as the one that occurred on January 6, 2005, in Graniteville, South Carolina, in which a release of chlorine, a material classified as a toxic inhalation hazard, caused 9 fatalities and 554 injuries.[13] The Lac-Mégantic accident and other recent accidents have demonstrated that the same potential for loss of life and damage to communities and the environment exists when accidents occur involving blocks of tank cars and unit trains transporting large volumes of flammable materials. Although the FRA actions under Emergency Order No. 28 acknowledge that better security is needed for unattended key trains, route planning and route selection protections currently required for explosive, toxic by inhalation, or radioactive materials are not required for trains transporting large bulk quantities of volatile flammable liquids through populated communities. The NTSB believes that at a minimum, the route assessments, alternative route analysis, and route selection requirements of 49 CFR 172.820 should be extended to key trains transporting large volumes of flammable liquid. Therefore, the NTSB recommends that PHMSA work with the FRA to expand hazardous materials route planning and selection requirements for railroads under 49 CFR 172.820 to include key trains transporting flammable liquids as defined by AAR Circular No. OT-55-N and, where technically feasible, require rerouting to avoid transportation of such hazardous materials through populated and other sensitive areas.

Oil Spill Response Plans

About 1.6 million gallons of crude oil were released from the derailed tank cars in Lac-Mégantic with initial cleanup costs estimated at more than $200 million. According to a report released by the Quebec Ministry of Sustainable Development, Environment and Parks, the released crude oil covered about 77 acres of surface area in the center of Lac-Mégantic, and petroleum related contaminants that entered the Chaudière River were transported as far as 74 miles away.[14] As devastating as the Lac-Mégantic accident was, it did not fully represent a worst-case (maximum potential) discharge, because 9 of the 72 tank cars at the rear of the train did not derail or release crude oil.

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[11] Bureau of Explosives, *Annual Report of Hazardous Materials Transported by Rail*, BOE 12-1 (Washington, DC: Association of American Railroads, Bureau of Explosives, 2013).

[12] J. Karl Alexy, "Crude Oil and Ethanol Transportation Trends" (presentation, 49th Railroad Safety Advisory Committee, Washington, DC, August 29, 2013).

[13] National Transportation Safety Board, *Collision of Norfolk Southern Freight Train 192 With Standing Norfolk Southern Local Train P22 With Subsequent Hazardous Materials Release at Graniteville, South Carolina, January 6, 2005*, RAR-05/04 (Washington, DC: National Transportation Safety Board, 2005).

[14] Quebec Ministry of Sustainable Development, Environment and Parks, *Déraillement ferroviaire raillement de Lac-Mégantic* (*Environmental Characterization, Lac-Mégantic Derailment, Preliminary Report*), (Quebec: Golder Associates, 2013).

The Lac-Mégantic accident shows that railroad accidents involving crude oil have a potential for disastrous consequences and environmental contamination equal to that of the worst on-shore pipeline accidents. The July 25, 2010, crude oil pipeline accident in Marshall, Michigan, released about 843,000 gallons of crude oil from a 30-inch-diameter ruptured transmission pipeline and was the most costly inland pipeline crude oil spill in the United States to date, with environmental remediation costs approaching $1 billion.[15] Although railroad accidents involving large numbers of crude oil tank cars can have similar outcomes, oil spill response planning requirements for rail transportation of oil/petroleum products are practically nonexistent compared with other modes of transportation. Current regulations do not require railroads transporting crude oil in multiple tank cars to develop comprehensive spill response plans and have resources on standby for response to worst-case discharges. Although simple plans must be developed, the plans are not reviewed to evaluate the capability of rail carriers to respond to and mitigate discharges.

Executive Order 12777[16] delegates to the DOT various responsibilities identified in section 311(j) of the Clean Water Act regarding discharges of oil and hazardous substances from transportation-related on-shore facilities. The PHMSA authority for on-shore transportation facilities (motor vehicles and rolling stock) is limited to promulgating regulations. Spill response plans are submitted to the Federal Motor Carrier Safety Administration and the FRA for highway carriers and railroads, respectively. Since 1996, regulations have been in place at 49 CFR Part 130 to require comprehensive response plans for oil shipments in bulk packages (cargo tank motor vehicles and railroad tank cars) in a quantity that exceeds 42,000 gallons in a single package. For smaller petroleum oil shipments—in bulk packages of 3,500 to 42,000 gallons—the regulations require a less detailed basic response plan.

A spill response plan is intended to help the transporter develop a response organization and ensure the availability of resources needed to respond to an oil release. According to 49 CFR 130.31, the plan also should demonstrate that the response resources will be available in a timely manner to reduce the severity and impact of a discharge. Federal regulations require all railroads that transport liquid petroleum oil to develop basic written response plans that describe the manner of response to discharges that may occur during transportation, take into account the maximum potential discharge, identify the private personnel and equipment available to respond to a discharge, and retain that plan on file at its principal place of business and at the dispatcher's office. A comprehensive written plan is required for carriers transporting bulk shipments that exceed the 42,000-gallon package size. Each of these carriers also is required to have a comprehensive written plan that

- is consistent with the requirements of the National Contingency Plan (40 CFR Part 300) and Area Contingency Plans;
- identifies a qualified individual having full authority to implement removal actions;

[15] National Transportation Safety Board, *Enbridge Incorporated Hazardous Liquid Pipeline Rupture and Release, Marshall, Michigan, July 25, 2010*, PAR-12/01 (Washington, DC: National Transportation Safety Board, 2012).

[16] *Federal Register* 56 (October 22, 1991): 54757.

- ensures by contract or other means the availability of private personnel and equipment necessary to remove a worst-case discharge;
- describes training, equipment testing, drills, and exercises; and
- is submitted to the FRA.

When a discharge occurs into navigable waters of the United States, the carrier is responsible for implementing the basic or comprehensive response plan.

In the preamble to the June 17, 1996, final rule,[17] the Research and Special Programs Administration (RSPA)[18] stated its belief that 42,000 gallons in a single packaging is an appropriate and reasonable liquid quantity for a finding that a release would cause substantial harm to the environment, and thus should be the threshold for comprehensive planning. However, RSPA noted that on the basis of available information, no rail carrier was transporting oil in a quantity greater than 42,000 gallons in tank cars. During 1996, when the rulemaking was being considered, there were only 67 tank cars listed in the AAR UMLER[19] file with a capacity equal to or greater than 42,000 gallons. Only six of these cars were being used to transport oil or petroleum products.

The NTSB finds that as currently written, the regulation circumvents the need for railroads to comply with spill response planning mandates of the federal Clean Water Act. Although the DOT 42,000-gallon threshold for comprehensive response plan development is equivalent to an unrelated threshold contained in a spill prevention, control, and countermeasures rule administered by the US Environmental Protection Agency for nontransportation related oil storage facilities,[20] the DOT regulation is rendered ineffective because of its lack of applicability to any real-world transportation scenario. By limiting the comprehensive planning threshold for a single tank size that is greater than any currently in use, spill-planning regulations do not take into account the potential of a derailment of large numbers of 30,000-gallon tank cars, such as in Lac-Mégantic where 60 tank cars together released about 1.6 million gallons of crude oil.

RSPA stated further that the risk to the marine environment posed by oil in transport is proportional to the quantity of oil that could be discharged in an accident, and when the rule was developed 17 years ago, it was based on the relatively few petroleum shipments by tank car that were not being assembled as unit trains. The NTSB believes that because conditions have significantly changed with the recent massive growth in crude oil transportation, the regulations are no longer sufficient to mitigate the risks of petroleum product releases in accidents. Although no one tank car meets the current threshold for comprehensive spill planning, the Lac-Mégantic accident and the well-known poor lading retention performance history of DOT-111 tank cars

[17] *Federal Register* 61, no. 117 (June 17, 1996): 30533.

[18] RSPA was abolished by act of November 30, 2004 (118 Stat. 2424-2426), and certain duties were transferred to both PHMSA and the Administrator of the Research and Innovative Technology Administration, DOT.

[19] UMLER refers to the Universal Machine Language Equipment Register, which is a file of vital statistics for each rail car in service.

[20] Under 40 CFR Part 112, if the facility transfers oil over water to or from vessels and has a total oil storage capacity greater than or equal to 42,000 gallons it could, because of its location, reasonably be expected to cause substantial harm to the environment by discharging oil on the navigable waters or adjoining shorelines.

have demonstrated that the worst-case release potential of these unit trains, in many cases greater than 2 million gallons, must be considered in the oil and hazardous materials spill planning process.

US Coast Guard regulations for marine tank vessels require spill response planning to address a worst-case discharge, which is defined as the entire cargo on the vessel. Planning to respond to maximum potential releases for trains transporting crude oil, many of which are configured in unit trains as "virtual pipelines" of tank cars, also must take into account the entire quantity of lading. Therefore, the NTSB recommends that PHMSA revise the spill response planning thresholds contained in 49 CFR Part 130 to require comprehensive response plans to effectively provide for the carriers' ability to respond to worst-case discharges resulting from accidents involving unit trains or blocks of tank cars transporting oil and petroleum products.

Hazardous Materials Packing Group Classification

The MMA train originated from a tank truck-to-rail car transloading facility in New Town, North Dakota, operated by Strobel Starostka Transfer (SST) on behalf of subsidiaries of World Fuel Services Corporation. The original bills of lading that SST provided to Canadian Pacific Railway described the hazardous material as a Hazard Class 3 flammable material, Packing Group III.

Packing groups indicate the degree of danger presented by the material as either high, medium, or low (Packing Group I, II, or III, respectively).[21] The table below shows the flash point and initial boiling point criteria for each packing group.

Table. Hazardous Liquids Class 3 Packing Group Criteria

Packing Group	Flash Point	Boiling Point
I	N/A	≤ 35°C
II	< 23°C	> 35°C
III	≥ 23°C ≤ 60°C	> 35°C

The intensity of the postaccident fire in Lac-Mégantic and the apparent low viscosity of the crude oil product prompted the TSB to collect and analyze samples of the product from nine undamaged tank cars in the train and from two tank cars in a second crude oil train stationed in Farnham, Quebec, to determine if the shipments had been properly described and the appropriate packing group assigned. Test results indicate the flash point was less than -35°C and the initial boiling point was between 43.9°C and 48.5°C, which placed this product in the lower end of the crude oil flash point range, well below the parameters for Packing Group III materials. Thus, the test results confirmed the crude oils on these trains had been incorrectly assigned to Packing Group III, and they should have been assigned to the more hazardous Packing Group II.

[21] Packing groups for Class 3 materials are defined in 49 CFR 173.121.

The crude oil on the accident train was derived from 11 different suppliers from producing wells in the Bakken Shale formation region of North Dakota, and the suppliers classified it as a Class 3 hazardous material with the packing group varying from Packing Group I to Packing Group III. Investigators determined that the hazardous materials shipping papers provided by trucking companies transporting crude oil from the wells to the tank transloading facility indicate the crude oil was Packing Group II, although these companies could not provide evidence that the oil had been tested to assign the appropriate packing group. Investigators learned that after these loads were placed into rail tank cars, the bills of lading SST provided to the Canadian Pacific Railway described the crude oil as Packing Group III. The accident train with the same incorrect Packing Group III waybill information was interchanged to the MMA in Montréal.

On September 11, 2013, the TSB issued Rail Safety Advisory Letter 13/13, which recommended that PHMSA review its procedures for suppliers and companies transporting these products to ensure the product properties are accurately determined and documented for safe transportation.

The packing group classification requirements of the Hazardous Materials Regulations include the packaging that must be used to ship the material. The packing group classification determines authorized filling densities and outage requirements, hazard communications (marking, labeling, and placards), transportation safety and operational controls, and safety and security planning. Proper identification of hazardous materials is required to ensure emergency responders understand the hazards associated with the shipped material.

The NTSB investigated several accidents involving DOT-111 general service tank cars, and identified the vulnerability of tank heads, shells, and fittings to damage and subsequent release of lading during derailments. In the most recent accident report focusing on the crashworthiness of DOT-111 tank cars as a result of the derailment of a CN freight train transporting denatured ethanol in Cherry Valley, Illinois,[22] the NTSB issued the following safety recommendation to PHMSA:

<u>R-12-5</u>

> Require that all newly manufactured and existing general service tank cars authorized for transportation of denatured fuel ethanol and crude oil in Packing Groups I and II have enhanced tank head and shell puncture-resistance systems and top fittings protection that exceeds existing design requirements for DOT-111 tank cars. (Currently classified "Open—Acceptable Response.")

Additionally, the AAR developed new design criteria for tank cars built for the transportation of Packing Groups I and II materials with the proper shipping names Petroleum Crude Oil, Alcohols, n.o.s., and Ethanol and Gasoline Mixture.[23] These standards published in

[22] National Transportation Safety Board, *Derailment of CN Freight Train U70691 With Subsequent Hazardous Materials Release and Fire, Cherry Valley, Illinois, June 19, 2009*, RAR-12/01 (Washington, DC: National Transportation Safety Board, 2012).

[23] *n.o.s.* means not otherwise specified.

the AAR *Manual of Standards and Recommended Practices, Specifications for Tank Cars*, M-1002, require that all such tank cars ordered after October 1, 2011, in Packing Groups I and II service must meet the following criteria:

> Class 111 tank cars used to transport Packing Group I and II materials with the proper shipping names Petroleum Crude Oil, Alcohols, n.o.s., and Ethanol and Gasoline Mixture, must have heads and shells constructed on normalized TC128 Grade B steel or normalized A516-70 steel. Tank car heads must be normalized after forming, unless approval is granted by the AAR Executive Director of Tank Car Safety on the basis that a facility has demonstrated that its equipment and controls provide an equivalent level of safety. For tanks constructed of normalized TC128 Grade B steel, non-jacketed tanks must be at least 1/2-in. thick and jacketed cars must be at least 7/16-in. thick. For tanks constructed of normalized A516-70 steel, non-jacketed cars must be at least 9/16-in. thick and jacketed cars must be at least 1/2-in. thick. In all cases the cars must be equipped with at least 1/2-in. half-head shields.

Federal regulations at 49 CFR Part 179, Subpart D, do not provide the same level of protection as the industry standard, and they allow DOT-111 tank cars to be built of nonnormalized steel to a lesser plate thickness of 7/16 inch, with no provision for a jacket or head shield.

The August 2, 2013, FRA and PHMSA joint safety advisory recommended that shippers evaluate their processes to ensure that all hazardous materials are properly classed and described in accordance with the Hazardous Materials Regulations. Although the NTSB agrees with the broad scope of this recommendation, the absence of a product testing requirement to properly classify hazardous materials may lead shippers or carriers to rely on incorrect information or refer to generic data sheets that may not accurately represent the nature of the material being shipped. Such was the case with 10 inconsistent safety data sheets for the crude oil that was loaded in the tank cars that derailed in Lac-Mégantic. Several of these data sheets were developed by companies that had no involvement in the production of crude oil in the Bakken Shale region. Two of the data sheets indicated it was necessary to "determine the flash point accurately to classify the packing group."

Although PHMSA issued an Advanced Notice of Proposed Rulemaking on September 6, 2013, to address safety improvements for DOT-111 tank cars,[24] the regulations do not require the use of currently available, improved tank cars for Packing Groups I and II crude oil or other hazardous materials.

On October 17, 2013, Transport Canada issued Protective Direction No. 31 directing any person engaged in importing or offering crude oil for transportation in Canada to provide results for packing group classification testing and a safety data sheet for the tested product to Transport Canada. Until such time as testing is completed, any person transporting crude oil in Canada must ship the oil as a Class 3 flammable liquid, Packing Group I, and meet the requirements established for this classification.

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[24] *Federal Register* 78, no. 173 (September 6, 2013): 54849.

The shipper's responsibility under the Hazardous Materials Regulations at 49 CFR 173.22 mandate classifying and describing the hazardous material in accordance with Parts 172 and 173. The regulations at 49 CFR 172.204 also require the shipper to declare that the contents of a consignment are fully and accurately described and classified. In several interpretation letters issued on these regulations, PHMSA has stated it is the shipper's responsibility to properly classify and describe a hazardous material and that such determinations are not required to be verified by PHMSA. However, proper classification of hazardous materials is one of the most important responsibilities of the shipper because all other requirements for safe transportation are dependent on accurate identification.

Although the regulations prescribe test methods to assign the appropriate classification, there is an assumption that shippers have exercised the necessary due diligence and testing to ensure their shipments are properly described.[25] However, the record-keeping requirements of the Hazardous Materials Regulations do not require shippers to maintain evidence to demonstrate that the physical and chemical properties of a hazardous material have been sufficiently evaluated to justify the description and classification used for transportation. For example, for classification of a flammable material, 49 CFR 173.120 and 173.121 provide specific flash points and initial boiling points for determining if the material meets the definition of a flammable material and for classification into the appropriate packing group. The regulations are silent on whether a shipper must test the product or whether the shipper may rely on manufacturer data or even the shipper's own undocumented knowledge for determining the applicable shipping requirements.

On November 20, 2013, PHMSA and the FRA jointly issued Safety Advisory 2013-07 to reinforce the importance of proper characterization, classification, and selection of packing group for flammable materials.[26] The safety advisory emphasized specific definitions for the proper classification of petroleum crude oil and selection of shipping names and packing groups. The advisory also announced that PHMSA recently initiated the "Operation Classification" initiative, in which PHMSA and the FRA will conduct unannounced inspections and testing to verify hazardous material classifications selected and certified by shippers of petroleum crude oil. Although the NTSB applauds this enforcement initiative, product testing or other acceptable forms of proof are needed to document the decisions made by shippers of crude oil and other hazardous materials when they classify materials for transportation. Moreover, shippers should be required to maintain these records so inspectors are able to evaluate the accuracy of hazardous materials classifications.

On January 2, 2014, PHMSA issued a safety alert addressing the flammability characteristics of the crude oil produced from the Bakken Shale region in the United States.[27] When it announced the safety alert, PHMSA noted that the alert reinforces "the requirement to properly test, characterize, classify, and where appropriate sufficiently degasify hazardous

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[25] Certain Class 1 explosive materials have specific testing and records retention requirements. See 49 CFR Part 173, Subpart C.

[26] *Federal Register* 78, no. 224 (November 20, 2013): 69745.

[27] Pipeline and Hazardous Materials Safety Administration, *Safety Alert, January 2, 2014: Preliminary Guidance from Operation Classification* (Washington, DC: US Department of Transportation, Pipeline and Hazardous Materials Safety Administration, 2014).

materials prior to and during transportation." It also stresses that offerors[28] "must ensure that all potential hazards of the materials are properly characterized," and assign the appropriate classification and packing group of crude oil shipments.

The NTSB believes that properly classified shipments are paramount for appropriate package selection, for assessment of risks to develop meaningful safety and security plans, and for the safety of emergency responders and other individuals who may come into contact with hazardous materials in transportation. Therefore, in support of TSB Safety Advisory Letter 13/13 the NTSB recommends that PHMSA require shippers to sufficiently test and document the physical and chemical characteristics of hazardous materials to ensure the proper classification, packaging, and record-keeping of products offered in transportation.

Investigators are still examining issues related to the Lac-Mégantic, Quebec, accident. At this time, the TSB has not made any final conclusions about this accident. Nonetheless, the NTSB has identified the safety issues described above, which should be addressed expeditiously. Therefore, the National Transportation Safety Board makes the following safety recommendations to the Pipeline and Hazardous Materials Safety Administration:

> Work with the Federal Railroad Administration to expand hazardous materials route planning and selection requirements for railroads under Title 49 *Code of Federal Regulations* 172.820 to include key trains transporting flammable liquids as defined by the Association of American Railroads Circular No. OT-55-N and, where technically feasible, require rerouting to avoid transportation of such hazardous materials through populated and other sensitive areas. (R-14-4)
>
> Revise the spill response planning thresholds contained in Title 49 *Code of Federal Regulations* Part 130 to require comprehensive response plans to effectively provide for the carriers' ability to respond to worst-case discharges resulting from accidents involving unit trains or blocks of tank cars transporting oil and petroleum products. (R-14-5)
>
> Require shippers to sufficiently test and document the physical and chemical characteristics of hazardous materials to ensure the proper classification, packaging, and record-keeping of products offered in transportation. (R-14-6)

The NTSB also issued three safety recommendations to the Federal Railroad Administration.

Chairman HERSMAN, Vice Chairman HART, and Members SUMWALT, ROSEKIND, and WEENER concurred in these recommendations.

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[28] Title 49 CFR 171.8 defines *offeror* as any person who (1) performs, or is responsible for performing, any pre-transportation function required under this subchapter for transportation of the hazardous material in commerce and/or (2) tenders or makes the hazardous material available to a carrier for transportation in commerce.

The NTSB is vitally interested in these recommendations because they are designed to prevent accidents and save lives. We would appreciate receiving a response from you within 90 days detailing the actions you have taken or intend to take to implement them. When replying, please refer to the safety recommendations by number. We encourage you to submit your response electronically to correspondence@ntsb.gov.

[Original Signed]

By: Deborah A.P. Hersman,
Chairman